MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Ordinary Level

Paper 1 Multiple Choice

October/November 2015

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Data Sheet is printed on page 15.
A copy of the Periodic Table is printed on page 16.
The use of an approved scientific calculator is expected, where appropriate.

21 Methanol boils at 65 °C and water boils at 100 °C.

Methanol and water are completely miscible with each other.

Which method is used to separate a mixture of these two liquids?

A evaporation

B filtration

C fractional distillation

D paper chromatography

22 Four bottles containing colourless solutions have no labels.

A series of individual tests are carried out on each of the solutions.

Which bottle contains ammonium chloride solution?

	test 1: add dilute hydrochloric acid	test 2: add warm aqueous sodium hydroxide	test 3: add dilute nitric acid and aqueous silver nitrate
A	fizzing	gas produced which turns damp red litmus blue	no reaction
B	no reaction	gas produced which turns damp red litmus blue	white precipitate forms
C	no reaction	gas produced which turns damp red litmus blue	no reaction
D	no reaction	no reaction	white precipitate forms

23 The nucleon number of an isotope of bromine is 81.

How many protons, neutrons and electrons are present in an atom of this isotope?

	protons	neutrons	electrons
A	35	46	35
B	35	46	46
C	37	44	35
D	37	44	37

24 Why does molten sodium chloride conduct electricity?

A An electron is completely transferred from sodium to chlorine.

B Electrons in the sodium chloride are free to move.

C Sodium ions are strongly attracted to the chloride ions.

D The sodium ions and the chloride ions are free to move.

25 0.1 mol / dm^3 hydrochloric acid reacts with 25 cm^3 of 0.2 mol / dm^3 aqueous sodium carbonate.

The equation for this reaction is shown.

$$2HCl + Na_2CO_3 \rightarrow 2NaCl + H_2O + CO_2$$

What is the volume of acid required to neutralise exactly this volume of sodium carbonate?

A 100 cm^3 **B** 50 cm^3 **C** 25 cm^3 **D** 6.25 cm^3

26 Four different solids, W, X, Y and Z, are dissolved in equal volumes of water at 20 °C.

The table shows the change in temperature when each solid dissolves.

	W	X	Y	Z
change in temperature / °C	+10	–8	–5	+15

Which row of the table describes the energy changes when each solid is dissolved in water?

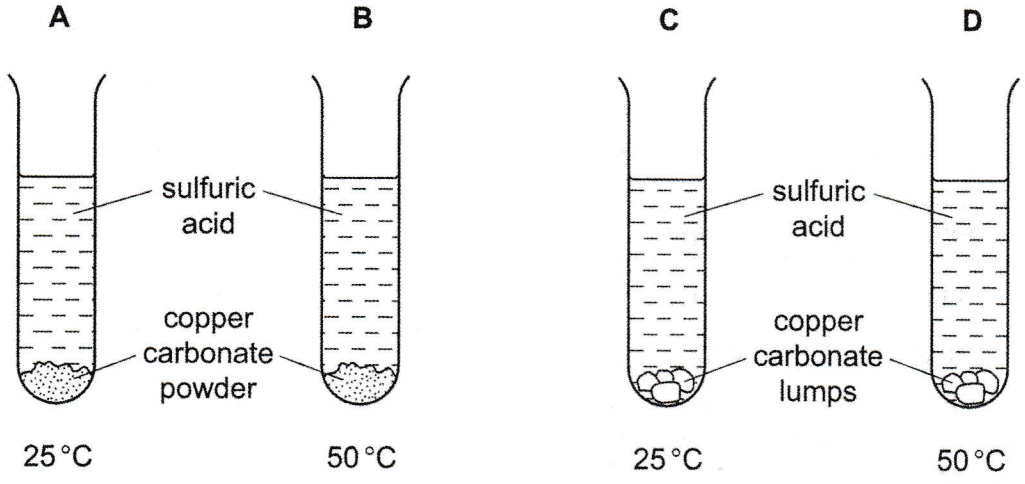
	solid which dissolves	type of energy change	solid which dissolves	type of energy change
A	W	endothermic	Y	exothermic
B	X	exothermic	W	endothermic
C	X	endothermic	Z	exothermic
D	Y	exothermic	Z	endothermic

27 Equal masses of copper carbonate are reacted with 20 cm^3 of 1 mol / dm^3 sulfuric acid.

The equation for the reaction is shown.

$$CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + CO_2 + H_2O$$

Which conditions produce carbon dioxide most rapidly?



28 Part of some chemical reactions are shown.

Which reaction represents oxidation?

A $Cl_2(g) \rightarrow 2Cl^-(aq)$

B $CuO(s) \rightarrow Cu(s)$

C $Fe^{3+}(aq) \rightarrow Fe^{2+}(aq)$

D $Zn(s) \rightarrow Zn^{2+}(aq)$

29 A student tests four different solutions with Universal Indicator.

solution	P	Q	R	S
colour with Universal Indicator	purple	green	red	yellow

What are the pH values of the four solutions?

	P	Q	R	S
A	2	9	4	7
B	4	7	8	9
C	9	5	12	2
D	12	7	2	5

30 An element X forms an ion X^{3-}.

Which group of the Periodic Table is this element found in?

A Group I

B Group III

C Group V

D Group VII

31 Which row shows the properties of a Group I metal?

	density	hardness
A	high	hard
B	high	soft
C	low	hard
D	low	soft

32 Which substance represents a metal?

	state at room temperature	melting point and boiling point	malleability	conduction of heat and electricity
A	liquid	low	non-malleable	poor
B	solid	high	malleable	good
C	solid	high	malleable	poor
D	solid	low	malleable	good

33 Water is formed when hydrogen is passed over the heated oxide of metal L.

No water is formed when hydrogen is passed over the heated oxide of metal M.

Which row shows the order of reactivity of hydrogen, metal L and metal M?

	most reactive ⟶		least reactive
A	hydrogen	L	M
B	L	hydrogen	M
C	L	M	hydrogen
D	M	hydrogen	L

34 Most aluminium cans are made from recycled aluminium.

Why are some aluminium cans still made from aluminium extracted from its ore?

A Aluminium ore produces better quality aluminium.

B Demand is not met by the recycling of aluminium alone.

C Extraction from the ore uses electricity and is expensive.

D There are only a limited number of times that aluminium can be recycled.

35 Which row does **not** match an atmospheric pollutant to its source?

	pollutant	source
A	carbon monoxide	complete combustion of fossil fuels
B	nitrogen oxides	car exhausts
C	nitrogen oxides	lightning
D	sulfur dioxide	volcanoes

36 Naphtha is one fraction obtained from the fractional distillation of petroleum.

What is the main use of naphtha?

A to provide a feedstock for the petrochemical industry

B to provide a fuel for aircraft engines

C to provide a material for road surfaces

D to provide lubricating oils

37 Alkanes are a homologous series of compounds.

The properties of the alkanes change as the size of molecules increases.

How do the properties change?

A The boiling point increases and the flammability increases.

B The flammability decreases and the viscosity increases.

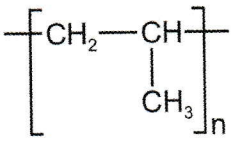
C The flammability increases and the melting point increases.

D The viscosity increases and the boiling point decreases.

38 Which hydrocarbon is an alkene?

A C_5H_{10} **B** C_5H_{12} **C** C_6H_6 **D** C_6H_{14}

39 The repeat unit of poly(propene) is shown.



Which row is correct?

	name of monomer	formula of monomer
A	propane	C_3H_6
B	propane	C_3H_8
C	propene	C_3H_6
D	propene	C_3H_8

40 An organic compound E reacts with acidified potassium manganate(VII) solution causing it to change colour.

What is E?

A ethane

B ethanoic acid

C ethanol

D poly(ethene)

21. (C)

EXAM TIP:

Fractional distillation is used to separate two miscible liquids with different boiling points.

22. (B)

Ammonium chloride is produced from the reaction of hydrochloric acid and aqueous ammonia, and hence does not react with hydrochloric acid.

Ammonium chloride reacts with sodium hydroxide to release ammonia gas according to the equation $NH_4Cl(aq) + NaOH(aq) \rightarrow NH_3(g) + NaCl(aq) + H_2O(l)$. The ammonia gas produced turns damp red litmus paper blue.

Ammonium chloride also reacts with silver nitrate to form silver chloride, a white precipitate, according to the equation

$NH_4Cl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + NH_4NO_3(aq)$.

EXAM TIP:

Ammonium chloride does not react with hydrochloric acid. Ammonia gas is produced when ammonium chloride reacts with sodium hydroxide. Ammonium chloride reacts with silver nitrate to form silver chloride.

23. (A)

The number of protons in the atom is equal to the number of electrons, i.e. 35, and there are 81 – 35 = 46 neutrons.

EXAM TIP:

Isotopes have the same number of protons and electrons but different numbers of neutrons. The nucleon number of 81 means the total number of protons and neutrons is 81.

24. (D)

Oppositely-charged ions in an ionic compound form giant ionic lattices, where the ions are not free to move and thus they are unable to conduct electricity in the solid state. When the ionic compounds are dissolved in water or in the molten state, the charged ions are free to move and are hence able to conduct electricity.

EXAM TIP:

The ions Na^+ and Cl^- in sodium chloride are bonded by ionic bonds.

25. (A)

$$\text{Number of moles of } Na_2CO_3 = \frac{25}{1000} \times 0.2$$
$$= 0.005 \text{ mol}$$

$$\text{Number of moles of HCl required} = 0.005 \times 2$$
$$= 0.01 \text{ mol}$$

$$\text{Volume of HCl required} = \frac{0.01}{0.1}$$
$$= 0.1 \text{ dm}^3$$
$$= 100 \text{ cm}^3$$

EXAM TIP:

Use the mole ratio provided by the balanced equation and apply the formula: $\text{Volume (dm}^3\text{)} = \frac{\text{Number of moles of solute}}{\text{Concentration (mol / dm}^3\text{)}}$.

26. (C)

An exothermic reaction releases energy to the environment, resulting in an increase in the temperature of its surroundings. Conversely, an endothermic reaction absorbs energy from its environment, causing a decrease in surrounding temperature.

EXAM TIP:

A positive change in temperature indicates an increase in surrounding temperature (exothermic) and a negative change in temperature indicates a decrease in surrounding temperature (endothermic).

27. (B)

The rate of reaction increases as temperature increases. The use of powdered copper carbonate increases the surface area, which also increases the rate of reaction.

EXAM TIP:

Higher temperature and smaller pieces of solid reactant increase the rate of reaction.

28. (D)

(A): The oxidation state of Cl decreased from 0 in Cl_2 to −1 in Cl^-, hence reduction occurred.

(B): The oxidation state of Cu decreased from +2 in CuO to 0 in Cu, hence reduction occurred.

(C): The oxidation state of Fe decreased from +3 in Fe^{3+} to +2 in Fe^{2+}, hence reduction occurred.

(D): The oxidation state of Zn increased from 0 in Zn to +2 in Zn^{2+}, hence oxidation occurred.

EXAM TIP:

Calculate the oxidation state of the reactant and product. During oxidation, the oxidation state of the element increases.

29. (D)

The colours of solutions with different pH values with Universal Indicator are listed:

pH < 3: red (R)

pH 3 – 6: yellow (S)

pH 7: green (Q)

pH > 11: purple (P)

30. (C)

The element X gains 3 electrons to form the ion X^{3-}. This shows that X has 5 valence electrons and belongs to Group V.

EXAM TIP:

For X to form an ion X^{3-}, X has to gain 3 electrons. Identify the group of the Periodic Table that consists of elements that tend to gain 3 electrons to obtain an electronic configuration of a noble gas.

31. (D)

Group I metals, also known as alkali metals, have relatively low densities and are soft.

32. (B)

EXAM TIP:

Metals generally exist as solids at room temperature (with the exception of mercury), have high melting and boiling points (with the exception of mercury), are malleable and are good conductors of heat and electricity.

33. (D)

Hydrogen displaces metal L from its oxide but not metal M. This shows that hydrogen is more reactive than metal L and less reactive than metal M.

EXAM TIP:

A more reactive substance displaces a less reactive substance.

34. (B)

The extraction of aluminium from its ore requires electrical energy, which is expensive.

Recycling is cheaper, but the demand for aluminium metal is greater than the supply of scrap aluminium for recycling.

EXAM TIP:

There is insufficient supply of scrap aluminium for recycling.

35. (A)

Carbon monoxide is produced from the incomplete combustion of fossil fuels.

EXAM TIP:

Carbon monoxide is produced from the incomplete combustion of fossil fuels; nitrogen oxides is produced from car exhausts or lightning; sulfur dioxide is produced from volcanoes.

36. (A)

EXAM TIP:

Naphtha is used as a feedstock for chemical industries.

37. (B)

As the number of carbon atoms increases, there is an increase in intermolecular forces of attraction which results in greater viscosity. Similarly, the amount of energy required for combustion increases as the number of carbon atoms increases, resulting in a decrease in flammability.

EXAM TIP:

The change in the size of the alkane molecules changes the physical properties of the alkanes, such as the flammability and viscosity.

38. (A)

EXAM TIP:

The general formula of alkenes is C_nH_{2n}.

39. (C)

Alkenes, and not alkanes, undergo addition polymerisation. Each monomer is a propene molecule with a molecular formula of C_3H_6.

EXAM TIP:

Count the number of carbon and hydrogen atoms in the structure of the monomer to identify the formula of the monomer.

40. (C)

Acidified potassium manganate(VII) acts as an oxidising agent. The colour change in acidified potassium manganate(VII) upon reaction with E shows that the solution has been reduced and E has been oxidised. Ethanol has been oxidised to form ethanoic acid.

EXAM TIP:

Ethanol reacts with acidified potassium manganate(VII) solution to form ethanoic acid.